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ELECTRIC INSECT TRAPS FOR SURVEY PURPOSES

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Cooperative investigations by the Farm Electrification Section, Agricultural Engineering Research Branch (ARS), U. S. Department of Agriculture with Federal and State agricultural engineers and entomologists have resulted in the design of three types of electric insect traps for survey purposes. These traps have all been field tested and, when equipped with the attractant herein described, have proven to be valuable tools for the collection of insects.

The Attractant:

The results of many tests have indicated that ultraviolet fluorescent-type lamps designated in the trade as "BL" (blacklight) lamps, which radiate energy in the near ultraviolet region (3200-3800 Angstroms) are most suitable for general insect attraction.

Almost all economic species which are known to be photopositive have been attracted by these BL lamps. Single 15-watt BL lamps have attracted several quarts of insects nightly in traps described in this paper. Other advantages of the BL lamp, in addition to its attraction ability, are its low cost ($1.10), long life (several thousand hours), and low energy consumption (electricity will cost only about 50¢ per month if operated continuously, night and day.) In

addition, the lamp bulb can be exposed to weather. The auxiliary equipment required to operate the lamp is relatively low in cost and is of standard fluorescent type.

One possible disadvantage of the BL lamp is that it may be too attractive, particularly if the trap operator is interested in catching only one or two specific species--he may have to sort through thousands of specimens of undesired species. Attempts are being made to determine the peak response of individual species in an effort to provide a selective attractant. It has been found that ordinary incandescent lamps (in 75-watt to 200-watt sizes) may be somewhat selective in attracting European corn borer moths; argon lamps (three 2-watt lamps per trap) appear particularly attractive to pink bollworm moths; and pink or green fluorescent lamps appear to be attractive to the striped and spotted cucumber beetles.

The Collecting Device:

This may be assumed to consist of two parts: (1) The lamp housing consisting of the lamp support, access opening or funnel to the killing or collecting chamber and, if used, trap roof, baffles and other accessories; and (2) The killing or collecting chamber.

Figures 1, 2, and 3 show three designs of lamp housings that have proven successful for survey traps. Figure 1 shows a uni-directional

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Figure 1.--Uni-directional trap with 15-watt BL lamp.

Figure 2.--Omni-directional trap with 15-watt BL lamp.

Figure 3.--Omni-directional trap with 15-watt BL lamp without cover.

type trap with the 15-watt BL lamp primarily visibly in one direction only. The two lamps under a canopy in the trap shown in Figure 2 are visibly essentially in all directions except directly above and below the trap. Figure 3 is an omni-directional trap with its 15-watt BL lamp visible in all directions (except for small area directly under the trap).

Two types of killing chambers are shown. The uni-directional and canopy-type traps (Figures 1 and 2) are shown with a glass jar for holding the killing agent and collecting the insects, while the omni-directional trap (Figure 3) is equipped with a metal can for this purpose. The can in Figure 3 has an inner screened top funnel for catching and exhausting the rainwater through an opening in the bottom of the collecting can.

It may be noted that the collecting can shown on the omni-directional trap may be used on the other two traps, although the canopy-type trap would have little need for the inner funnel water-removing feature since the large canopy effectively prevents most rainwater from entering the trap. The glass jars could not be used on the omni-directional trap, however, unless some other means is provided to prevent rain from entering the trap.

Any of the traps shown could be equipped with screened bags or boxes if it is desired to catch the insects alive. These would be attached to the bottom of the trap funnel in place of the jar or can. If the funnel opening is extended down into the screened chamber a few inches, few insects will escape.

Of the three types shown, the omni-directional trap (Figure 3) will generally, in a given location, catch the most insects. The inner funnel arrangement effectively prevents rainwater from damaging the insects and the large collecting can is advantageous in that the greater area and volume of the can aid in keeping the insects in better condition for identification provided they are killed quickly. This trap is recommended for general survey purposes.

The canopy-type trap (Figure 2) may be lower in cost than the omni-directional, and the large roof protects the insects from rain and dew. It also permits the use of a closed collecting jar since rainwater is excluded except during extremely hard blowing rains.

The uni-directional type has advantages of low cost, small size, light weight, and ease of mounting to a post or side of a building. This trap lends itself, also, to the use of inexpensive lampholders which are readily available. Its catches are generally smaller than those of the other types shown, however. It may collect rainwater unless special provisions are made in the funnel, or throat, of the trap to discharge the water before it reaches the collecting chamber; or unless a can of the type shown on the trap in Figure 3 is used. Plans for all three traps are available from the Farm Electrification Section, Agricultural Engineering Research Branch, Agricultural Research Service at Beltsville, Maryland.

<u>The Killing Agent</u>:

To allow later identification the killing agent used should be quick and effective under a wide range of temperature and moisture

conditions. No entirely satisfactory killing agent has been found. Calcium cyanide has possibly been most generally used and is fairly satisfactory if it is replaced daily. A common brown paper sack (about a No. 2 size) has been found to be most satisfactory for holding the cyanide in the jar or killing agent. Other killing agents which have been used successfully are carbon tetrachloride, tetrachloroethane and ethyl acetate. In all cases the operator should use extreme care in handling and storing these poisons.

Trap Mounting and Operation:

Traps of the type shown may be mounted on a post, bipod, tripod attached to the side of a building, or suspended from overhead. Metal parts of all traps should be connected to a good electrical ground such as underground metal water system or a driven pipe or rod. All ground connections should be interconnected to the grounded (neutral) conductor of the electrical system. The trap should be connected to the power source with weather-proof polarized connections. Under most conditions the lamps are allowed to operate continuously since the amount of energy used is very small. This assures that the trap will be on whenever the insects are flying without an operator having to remember to put the trap in operation or providing a switch or time-clock.

Traps are generally located in an open area, preferably near a host crop for the specific insect species desired. There appears to be some preference of certain species on trap height; a general rule, however, is to keep the trap just above the host crop.

More insects are generally attracted to uni-directional traps if such traps face downwind. Some form of wind barrier to the rear of such traps may help. Traps should be located in areas of comparative darkness, away from competing light sources.

Since the ultraviolet output of the BL lamp may decrease with time more rapidly than the visible output, it may be advisable to replace the lamps before they actually burn out, or once each season.

Insects should be collected from the traps at regular intervals--daily, if possible, and insects handled carefully after removal.

Lists of Insects Collected:

A partial list of some of the common economic insect species which have been attracted to the traps of the types shown when equipped with BL lamps, follows:

COLEOPTERA

Acalymma vittata (F.)	*Cyclocephala borealis* Arr.	*Ligyrus gibbosus* (DeG.)
Agonoderus lecontei Chd.	Diabrotica spp. Mann.	Phyllophaga spp.
Conoderus vagus (Cand.)		

DIPTERA

Culicidae spp.	*Musca domestica* L.
Hylemya antiqua (Meig.)	*Simuliidae*

HEMIPTERA

Adelphocoris lineolatus (Goeze)	*L. lineolaris* (P. deB.)
A. rapidus (Say)	*L. pabulinus* (L.)
Labopidea allii Knight	*Psallus seriatus* (Reuter)
Lygus pallidulus (Blanch.)	*Rhinacloa forticornis* (Reuter)

HOMOPTERA

Aphidae

Draeculacephala mollipes (Say)

Empoasca fabae (Harris)

LEPIDOPTERA

Agrotis gladiaria Morr.

Agrotis malefida Guen

Agrotis ypsilon (Rott.)

Alabama argillacea (Hbn.)

Amathes c-nigrum (L.)

Atteva surea (Fitch)

Autographa spp.

Bucculatrix canadensisella Chamb.

Caenurgina crassiuscula (Haw.)

Celerio lineata (F.)

Ceratomia catalpae (Bdvl.)

Choristoneura fumiferana (Clem.)

Crymodes devastator (Brace)

Diacrisia virginica (F.)

Elasmopalpus lignosellus (Zell.)

Estigmene acrea (Drury)

Faronta diffusa (Wlk.)

Feltia ducens (Wlk.)

Feltia subgothica (Haw.)

Feltia subterranea (F.)

Heliothis zea (Boddie)

H. virescens (F.)

Isia isabella (J. E. Smith)

Lacinipolia renigera (Steph.)

Laphygma frugiperda (J. E. Smith)

Loxostege similalis (Guen.)

Mocis latipes (Guen.)

Nephelodes emmedonia (Cram.)

Ommatopteryx ocellea (Haw.)

Papaipema nebris (Guen.)

Pectinophora gossypiella (Saund)

Peridroma margaritosa (Haw.)

Plathypena scabra (F.)

Prodenia ornithogalli Guen.

Protoparce quinquemaculata (Haw.)

P. sexta (Joh.)

Pseudaletia unipuncta (Haw.)

Pyrausta nubilalis (Hbn.)

Scotogramma trifolii (Rott.)

Simyra henrici (Grt.)

Strymon melinus (Hbn.)

Trichoplusia ni (Hbn.)

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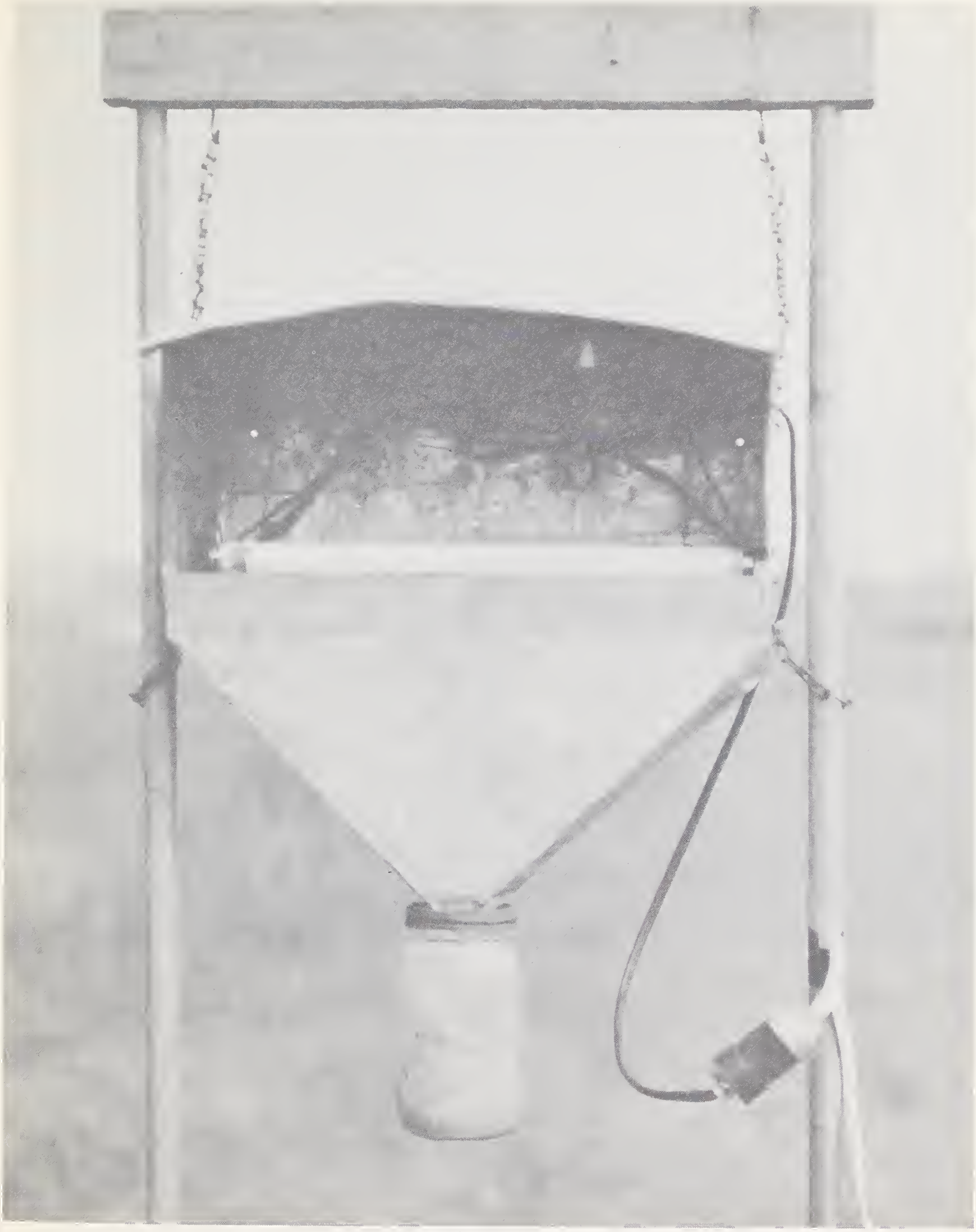

FIG. 1

FIG. 2

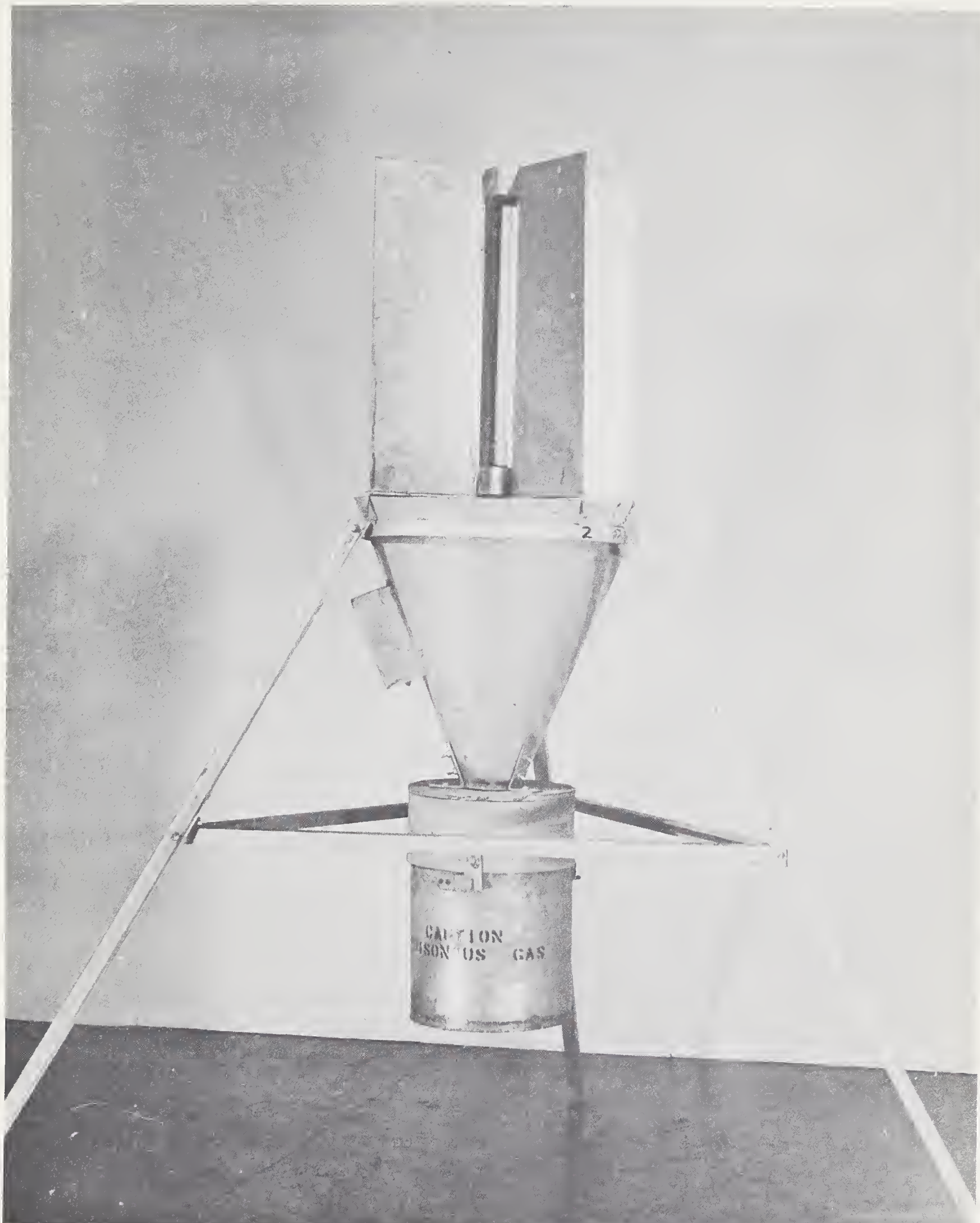

FIG. 3